habit, as well as the principle, that all discussion must be conducted fairly and kindly, and in a proper spirit, whoever may be on either side the controversy. Make all members of the profession welcome at headquarters; and let them see that they cannot, without injury to their own interests, defer becoming members of so representative and powerful a body of their comrades. We think the observing of these few simple principles will insure prosperity, without changes of constitution.

HEALTH MATTERS.

Chemical Salts developed in Living Organisms.

A MEMOIR by Mr. Robert Irvine and Dr. Sims Woodhead, entitled "Secretion of Carbonate of Lime by Animals," recently published in the "Proceedings of the Royal Society of Edinburgh," deals with the interesting question of the assimilation of food and the development of structures partially composed of a definite proportion of insoluble chemical salts. Thus, hens supplied with sulphate of lime, but no other lime salt, produce well-formed egg-shells composed of carbonate of lime. The process of shell-formation in the crab appears to differ chemically from egg-shell development in the hen. Sulphate of lime is not assimilated in the same manner, so that crabs which throw off their shells in artificial sea water in which sulphate of lime as well as chloride of sodium are present, but from which chloride of calcium is excluded, do not form a new exo-skeleton of carbonate of lime. As soon as chloride of calcium is added, although the sulphate be withheld, shell-formation may go on. The authors of the paper minutely describe the share which epithelial and other cells play in secreting, or causing the deposit of, chemical salts in shells and in bone. The histological and chemical processes differ considerably in bone, in egg-shells, in the shells of crustacea, and in the "mantle" of mollusca.

The Use of Leeches in Bacteriology.

Dr. Pasternatski has found that a very convenient method for collecting and preserving for cultivation the spirillum of relapsing-fever is to use leeches. If the leeches are kept in a cold place, the spirilla they contain preserve their vitality for a considerable period, much longer than they do when kept in capillary or other glass tubes. When exposed for some time to a temperature of from 27° C. to 30° C., the spirilla were found to undergo transformation into other forms.

Lead-Poisoning.

Investigations made this year appear to show, as reported by a contemporary, that the lead-miner does not really suffer in health more than any other worker under ground, as the ore is not in a condition to be absorbed by the body, but that lead-smelters and all engaged in the manufacture of lead, particularly white lead, run a very great risk of being contaminated sooner or later. It also appears that at Tyne-side, the chief centre of the English lead trade, there is one type of ailment which is rarely seen elsewhere, attacking those who have been engaged in the work only a few months, or even weeks, — a fatal disease, the principal victims being girls of from seventeen to twenty-three years of age. They rapidly display symptons of this form of toxemia in the way of severe headache, followed by colic and blindness: and unless they speedily leave work for a considerable period of time, and undergo most careful treatment, the fatal result is rapidly ushered in, usually with epileptiform convulsions and coma. It is remarkable, however, that but little trace of lead is found in their bodies after death, perhaps not more than a few grains in the internal organs, after they have been subjected to the most complete and exhaustive examination.

LETTERS TO THE EDITOR.

Osteological Notes.

VIRGIL never wrote a more truthful or more appropriate line than the one in which he says,

"Felix qui potuit rerum cognoscere causas."

How is the fact to be explained, that, with the exception of a single family, the marsupials have no patella, or, at the best, a very rudimentary one, when all the other orders of the *Mammalia*, as well as certain of the reptiles and birds before them, are thus supplied?

The patella is the largest of the sesamoid bones, and, like the other sesamoids, is developed in the course of a muscle or tendon, wherever marked friction occurs, or where protection or increased leverage is demanded. Placed on the anterior surface of the knee joint in the conjoined tendon of the four extensors of the leg (*quadriceps extensor*), this bone is of a triangular form, its base being turned upwards to receive the above tendon, and its apex downwards to be united by the strong ligament to the tubercle of the tibia.

John Bell says, "The patella is manifestly useful chiefly as a lever, gliding upon the fore-part of the thigh-bone, upon the smooth surface which is betwixt the condyles. The projection of this bone upon the knee removes the acting force from the centre of motion so as to increase the power; and it is beautifully contrived, that while the knee is bent, and the muscles at rest, as in sitting, the patella sinks down concealed into a hollow of the knee. When the muscles begin to act, the patella begins to rise from this hollow; in proportion as they contract, they lose their strength, but the patella, gradually rising, increases the power, and, when the contraction is nearly perfect, the patella has risen to the summit of the knee; so that the rising of the patella raises the mechanical power of the joint in exact proportion as the contraction expands the living contractible power of the muscles."

In the marsupials the patella may be entirely absent, or its place may be supplied by a cartilaginous disk, with occasionally slight specks of bony matter intermingled, or, in some cases, by a simple broadened expansion of the tendon. In only one family, the bandicoots (*Peramelidæ*), is this bone fully developed, and the groove in the femur, for its action, well marked. In the phalangers (*Phalangistidæ*), as also in the native cats (*Dasyuridæ*), the groove is broad and shallow, and the patella but slightly developed, consisting of a moderate thickening of the tendon *quadriceps extensor*.

In the flying phalangers (*Petaurists*), in the native bear (*Phascolarctos cenoreus*), and in the wombat (*Phascolomys*), as well as in the banded ant-eater (*Myrmecobius*), the anterior distal surface of the femur is almost plane from side to side, exhibiting no depression for a patella, which does not exist. In the opossums (*Didelphidæ*) there is a slight thickening of the tendon. In the typical kangaroo (*Macropus*), as well as in the kangaroo rat (*Hypsiprymnus*), the muscular tendon is fairly developed, and the femoral groove correspondingly well marked. Owen says that he has found a small patella in *Macropus bennetti*.

In searching for a solution of the problem thus presented, the low organization of the order of the *Marsupialia* must be especially recognized. They have close affinities with the reptiles and birds (*Sauropsida*), in most of which no patella exists. The presence of this bone in certain lizards among the reptiles, and in certain birds, offers no greater anomaly than its existence solely in one family of the marsupials. Then, again, we find similar provisions made for its absence in the reptiles, birds, and marsupials; viz., a prolongation and modification of that tubercle of the tibia which thus supplies increased leverage.

Moreover, there is nothing observable in the anatomy or in the habits of the bandicoots that would lead us to suppose that they specially needed a normally constructed patella. They are small, rat-like animals, about eighteen inches in length, having a singular gait, which is made up of jumping and running; and they live among stony ridges in the eastern and south-eastern portions of Australia. They are allied in their food to the placental *Insectivora*.

Cope, in his "Hard Parts of the Mammalia," says, "The existence of tibia and fibula of subequal size gave rise to two distal articular surfaces of the femur. The constant use of these in flexion and extension gave them the convexity which they possess in the *Mammalia*, — a process already commenced in the *Reptilia*. The strong tendon of the rectus muscles passing over the anterior face of the extremity gave rise to the rotular groove. This became better defined and more important after the development in placental mammals of a sesamoid bone or patella in the tendon."

The phylogeny of the marsupials is as yet closely surrounded by many doubts, which, however, paleontology is slowly but surely clearing away. It is probable that the earliest mammalian remains so far discovered are marsupial; that is to say, so far as brain and reproductive development are concerned. It is highly probable, also, that the relation between the marsupials and the still lower organized monotremes is a comparatively near one, although, as Marsh says, "we have as yet no hint of the path by which these two groups became separated from the inferior vertebrates." That they did become separated, and that the marsupials at least inherited the characters, more or less modified, which marked their reptilian ancestors, among which may be enumerated the entire absence or incomplete condition of a rotula or patella, there is much reason to suppose. D. D. SLADE.

Cambridge, Mass., July 17.

One of Dr. Hann's Teachings.

HOWEVER much or little the Sonnblick temperature observations of Dr. Julius Hann are going to teach us about the nature and cause of cyclones, I think we may at least profit by the example which he affords us, in the spirit with which he has conducted his discussions of meteorological topics with those who differed from him. In the valuable papers which Professor Abbe translated for the "Smithsonian Report of 1877," Dr. Hann has frequent occasion to reply to his critics, Capt. Hoffmeyer, Reye, and others; and he does so not only in a tone of courtesy, such as a true gentleman would naturally employ, but also with an evident desire, in the interests of science, and quite regardless of personal pride in his own consistency, to reconcile conflicting views as far as possible. Is not this the best way in which to ascertain and establish the truth? RESEARCH.

The Aurora.

IN the course of an extended research in regard to the relation of the aurora to magnetic and solar conditions, in which I have been engaged for several years, the question as to whether atmospheric movements are affected has been considered. Incidentally the matter of tornadoes, touched upon by Professor Hazen in the last of his articles upon that subject thus far published, has been taken into the account. As his table on p. 30 of *Science* for July 18 appears to indicate, at least for the years for which the more complete reports are to be had, a relation of some sort to a disturbed condition of the sun appears to exist. His method of attempting to show in detail the "specific influence of spots" is not, however, quite complete. For instance: the glowing eruptions known as the *faculæ* are far more intimately related to magnetic storms, and presumably other phenomena, than are the spots. It is not my purpose to enter upon the discussion in detail at present. Tables are in existence, and in process of verification, which may one day be published if found complete after searching tests to which they are being submitted. Enough has been learned to warrant the positive affirmation that this subject has not yet been exhausted. Certainly there is room for improvement in knowledge of the causes of sudden intensification of storm energy. M. A. VEEDER.

Lyons, N.Y., July 21.

BOOK-REVIEWS.

Contributions to American Educational History, Nos. 8 and 9. Ed. by HERBERT B. ADAMS. Washington, Bureau of Education. 8°.

THE first of these pamphlets is a "History of Education in Alabama," by Willis G. Clark, and is mainly devoted to the University of Alabama and other collegiate institutions. The history of the State University is recounted at tedious length, and with a particularity out of all proportion to its importance. The other institutions, both colleges and academies, are more briefly dealt with, while the public schools are dismissed with a very short notice indeed. The system of public education is of very recent growth; and even now, as Mr. Clark states, the schoolhouses are altogether insufficient to accommodate the pupils. What the real quality of the various schools is, it is impossible from this pamphlet to clearly make out. In treating of the University of Alabama, for instance, Mr. Clark has a great deal to say about the finances of the institution, the lives of the various professors, the quarrels between professors and students, and other matters of minor importance; but what the course of study there actually is, how strictly it is pursued, and how the education furnished there compares with that given by other universities, Mr. Clark does not sufficiently inform us. Yet these are just the things that readers most wish to know. As far as it goes, however, his work seems to have been carefully and conscientiously done.

The other pamphlet in our hands is "The History of Federal and State Aid to Higher Education in the United States," by Frank W. Blackmar. It begins by recounting what the general government has done in this direction, partly by land grants to the States for educational purposes, and partly by the establishment and maintenance of the Smithsonian Institution, the Naval and Military Academies, the Library of Congress, and other institutions of an educational character. Then, taking up the States in detail, it shows what each of them has done in founding and maintaining colleges and universities, and also agricultural and technical schools. Mr. Blackmar has used much care and diligence in collecting his facts, and his work will be useful for reference; but it cannot be called a readable book. It is, in short, a mere catalogue of facts, set forth in a dry and technical style; and it does seem as if the subject might have been treated in a more interesting manner.

Reflections on the Motive Power of Heat and on Machines fitted to develop that Power. By N. L S. CARNOT. Tr. by R. H. Thurston. New York, Wiley. 12°. $2.

BOTH publisher and author, in the case of this book, disclaim any expectation of reaping large pecuniary reward. Yet there are many reasons why this first English translation of a scientific work, that lay buried and unknown for many years till Sir W. Thomson chanced on it, and found in it the true explanation of the mode of working of the steam-engine, should have a place in every library where such epoch-marking books are to be expected.

The Carnot whose contributions to physical science are made public in this volume was born in the smaller palace of Luxembourg, June 1, 1796. His father was prominent in the political life of France during the close of the last century, and his grandnephew of the same name — Sadi Carnot — is now president of the French republic. He early manifested an interest in mechanics, which induced his father to give a scientific bent to his son's education. Naturally, in the absence of the polytechnic schools of the present day, this education was obtained in the military schools. As a result, Sadi Carnot, at the age of twenty-three, found himself in Paris on a long furlough, which gave him the leisure and opportunities for study which he had earnestly desired.

He diligently followed the course of the College of France and of the Sorbonne, of the École des Mines, of the Museum, and of the Bibliothèque. His interest in mechanics led him to the workshops, and in the fine arts to the study of painting and music.

In 1826 a return to active military duties was necessitated; but two years later, Sadi Carnot laid aside his uniform, that he might be free.

It was before this time, in 1824, that the paper on the motive power of heat was published. He had noticed how little advance had been made in steam-engines, and that such advances as were accomplished had come largely as the result of accident. It must be remembered that at that time the conservation of energy was unknown. This Carnot first suspected and then established, so far as the conversion of heat into work was concerned. Yet the scientific atmosphere of his time was so saturated with the idea that heat was material, that he made no use of this conversion of heat into work in his typical heat-engine, now so well known as Carnot's engine. He allowed the prevailing errors to dominate him in this wonderful elucidation of the essentials of an engine that shall give work for heat. Not only did he show the necessity of having a hot body and a cold body for the working of a